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ABSTRACT

Whether an organization has its own facilities and programs to teach people to perform the jobs necessary to accomplish its purpose, or sends its prospective employees to schools outside its own confines to receive that training, occupational education and training is big business. One problem with occupational training programs is that such programs often overtrain prospective employees, i.e., train them for any task they might possibly need to perform, rather than merely those they will have to perform. While this may seem like a good idea, it has pitfalls: employees may become disenchanted when they do not get to do some of the interesting jobs for which they have been trained, resulting in attrition, or training may be too early to be remembered if it ever is needed. As an alternative to this approach, the Air Force has adopted a cost-effective approach to training. This approach suggests that, for most circumstances, one ought to provide training to employees in only those areas in which the probability is high that they will use that training on their subsequent job. In order to implement this policy, the U.S. Air Force Occupational Measurement Center, located at Randolph Air Force Base, Texas, conducts the Air Force's Occupational Analysis Program. One of the primary purposes of this program is the identification of tasks and groups of tasks that are performed by Air Force personnel in given career fields. These tasks are determined by occupational surveys. Air Force occupational analysis is a four-stage process that includes inventory development, survey administration, data analysis, and interaction with data users. These procedures provide a theoretical basis for cost-effective Air Force training programs. (KC)

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COST-EFFECTIVE TRAINING THROUGH JOB ANALYSIS

presented to the
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by

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COST-EFFECTIVE TRAINING THROUGH JOB ANALYSIS

Whether an organization has its own facilities and programs to teach people to perform the jobs necessary to accomplish its purpose, or sends its prospective employees to schools outside its own confines to receive that training, the fact remains that occupational education and training is big business. Both the organization and the agency providing the training have two major concerns: training must prepare trainees to perform the jobs they will be hired to perform, and training should be accomplished in as economical a fashion as possible. Often, these two goals appear to be in conflict with one another and may spawn philosophies of training that contradict one another. On the one hand, we would like to see graduates of our training programs who can perform any and every task they may conceivably be called upon to perform. On the other hand, providing the training necessary to ensure such a broad spectrum of capability may be prohibitively expensive.

The purpose of this paper is to suggest that training programs can be developed which at one and the same time will prepare course graduates to perform the jobs they will be called upon to perform, and will do so in a cost-effective manner. I will begin with a discussion of what may be called the philosophy of overtraining, pointing out several pitfalls in what may at first appear to be a most desirable approach to occupational education. I will then turn to a description of an occupational analysis procedure employed by the US Air Force which provides the data base necessary for developing and maintaining cost-effective occupational training programs. I will conclude with some examples of how this methodology has worked in the Air Force to help prepare personnel for duty in over 300 career fields.

PHILOSOPHICAL BACKGROUND

Overtraining: An Intuitively Attractive Approach

Ask any manager responsible for the work of others what it is that he or she looks for in a training program, and most will tell you they would like an employee who has been thoroughly trained in every facet of what may be remotely associated with his or her job. If the employee is to repair jet engines, for example, most supervisors would be pleased indeed if that employee had a firm knowledge base in thermodynamics, as well as being able to fix the engine when it is broken. Many managers would consider a thorough understanding of the electronic theory on which sophisticated avionics hardware is designed to be a real plus for the individual responsible for removing defective black boxes from aircraft and replacing them with other black boxes. After all, given the choice, wouldn't you as a manager prefer the new employee who had more training over the one who had less? And in any case, if the utility of particular training is in doubt, then shouldn't we provide the training "just to be on the safe side"? In other words, this philosophy of "overtraining" suggests that extra training won't hurt, and it ensures that trainees receive training on virtually anything they might encounter on their future jobs. The implicit assumption is that an individual who has completed a training program which espouses this "overtraining" philosophy will be a

more valuable asset to the organization in the long run than will one who has received a more limited amount of training, even if the process is more expensive in the short term. But will he be?

The Costs of Overtraining

There are serious problems with occupational training programs which provide trainees with more knowledge than they need to perform their jobs. First, overtraining may engender in the student a set of expectations about what his eventual job will be like when he completes his training. The logical assumption for the student to make is, "I must be going to do this, or they wouldn't be teaching me to do this." If "this" is particularly interesting or exciting to the student, then he begins to build a set of positive expectations about what his job will be like; and if, when he gets into the occupation, those expectations are not fulfilled, his reaction could be detrimental to the organization. For example, he might feel that he has been conned, and thus resent the organization and everything associated with it. Or, he may accept the lack of relationship between his training and his job and carry on in some state of confusion. But even more likely is the prospect of his reacting with disappointment and dissatisfaction with a job that does not fulfill his expectations--expectations which he logically formed but which in his view have remained illogically unfulfilled. What compounds the problem of dissatisfied personnel is the probability that, because they are dissatisfied, they may well leave the organization at the earliest opportunity, taking with them their experience and some very expensive training.

This brings us to the second major problem with overtraining--the problem of cost. Much of today's occupational training is expensive, particularly in some of the more high-tech electronics areas. When dissatisfied individuals leave an organization for whatever reason, costs, in the form of both lost expertise and replacement training, can be astronomical. And when those losses are the result of the organization's own doing, as is the case when it builds or commissions elaborate training programs which pump large sums of money into training that is never used, the organization is probably getting just what it deserves.

There are other costs associated with overtraining besides those involving the loss of dissatisfied personnel. Put simply, while it may be desirable to have an employee who has been trained to do just about everything, it is nevertheless true that very few employees in fact do everything. And it makes little economic sense to train 100 percent of the work force to perform tasks that only 15 or 20, or even 30 percent, will actually be called upon to perform. While it is true that many employees will change jobs during their tenure with an organization and may hence be called upon to perform many diverse tasks over the course of several years, overtraining the new recruit is still a wasteful proposition. Many of the potentially trainable tasks may be performed by the trainee shortly after completion of his training, and those are obvious candidates for coverage in the training program. However, tasks which are not likely to be performed soon after the employee becomes productive are poor candidates for inclusion in the training program. Training students on these kinds of tasks is not only expensive--since they may leave the organization before they have the chance to perform them--it may

be just plain foolhardy, particularly in the case of highly technical material. In the first place, there is every likelihood that the individual will forget many technical aspects of training received years before it is needed. And second, even if the training is remembered, the subject matter may become obsolete before the skill or knowledge can be employed.

An Alternative Approach: Cost-Effective Training

The previous discussion is not just a fantasy, no mere strawman I have built to subsequently knock down to justify some other program of equally questionable utility or economy. The fact of the matter is that the overtraining mentality is an approach to which any large organization in the business of training its own employees may fall prey. The US Air Force is no exception. In the late 1960s and early 1970s, some Air Force training programs contained what has since become known as "nice to know" information. But in 1973, money suddenly got tight. It became apparent that training cuts would be unavoidable. A new philosophy of training was needed, one which would get the most out of a limited number of training dollars. The new philosophy which emerged can best be described as a cost-effective approach to training, and it is a philosophy to which the US Air Force adheres to this day. This approach to training suggests that, for most circumstances, one ought to provide training to employees in only those areas where the probability is high that they will use that training on their subsequent job. Such training, which has a high probability of use by the employee on the job, is good training because it enables the employee to do his job, and it avoids the pitfalls of generating false expectations, confusion, dissatisfaction, and waste.

COST-EFFECTIVENESS THROUGH JOB ANALYSIS

Cost-effective Air Force training is based on the concept that formal technical training should consist primarily of instruction on those tasks for which the probability of performance by airmen in their first enlistment is high. Tasks performed in subsequent enlistments, or which are performed by only a small percentage of airmen in their first enlistment, generally can be more cost-effectively trained on the job or in subsequent follow-on courses given at a time when actual performance of the task is required. The basic problem with implementing this philosophy is to identify which tasks are performed by a large percentage of employees in that initial period after completion of the training program. The US Air Force Occupational Measurement Center, located at Randolph AFB, Texas, conducts the Air Force's Occupational Analysis Program. While the purposes of this program are many and varied, one of its primary purposes is the identification of tasks and groups of tasks which airmen in given Air Force career fields perform. Specifically, Air Force occupational surveys are conducted for Air Force career fields to determine the tasks performed and the percentage of airmen in various subgroups within the career field who perform them. A brief description of the Air Force occupational survey process, in terms general enough to illustrate the process's applicability in other organizational contexts, should serve to demonstrate how the cost-effective philosophy of training can be operationalized to solve the apparent dilemma described at the beginning of this paper.

Air Force Occupational Analysis Procedures

Air Force occupational analysis can best be described as a four-stage process which begins with the building of a data-gathering instrument or questionnaire called a USAF Job Inventory. Stage two of the process involves administration of the job inventory to job incumbents. Next, those data are analyzed to determine, among other things, what tasks people in the career field are performing and how much time they're spending on those tasks. Finally, the results of the survey are provided to career field management and training personnel in the form of a written report, called an Occupational Survey Report, and through personal interactions between the survey analyst and various users of the data.

Inventory Development. Inventory development has as its goal the development of a two-part questionnaire. One part, called the Background Information Section, contains questions designed to identify specific characteristics about the respondent (such as the location of his job, the level of experience he has in the career field, and the kinds of training he has had); and general information about the respondent's job (such as the types of equipment the respondent employs in the performance of his job and the degree to which the respondent feels his job utilizes his talents and training). The second part of the questionnaire, called the Task Inventory, is a listing of all the tasks that might conceivably be performed by an individual assigned to the career field being surveyed.

Development of the survey instrument is a painstaking and time-consuming process involving travel to locations throughout the work force. Such travel is necessary to ensure that every task is included in the inventory, even those performed at obscure locations out of the mainstream of career field activities. The inventory developer will interview subject-matter experts at two kinds of locations: those where people are doing tasks representative of most of the career field and those where unique functions are being carried out. In addition to refining the task inventory with respect to content of specific tasks, the developer ensures that tasks are worded in such a way so as to communicate the same understanding to all members of the career field, thus avoiding ambiguity in the task statements. The whole process takes from 6 to 8 months, but the time spent is well worth it, since the data obtained in an occupational analysis can be no better than the instrument used to collect them.

Survey Administration. Air Force occupational analysis is predicated on the idea that if you want to know what an individual does on the job, the best way to find out is to ask him. Research completed by the Air Force Human Resources Laboratory (which developed the technology used by the Occupational Measurement Center to conduct these occupational analyses) has demonstrated that job incumbents are the best source for reliable and valid information concerning what they do on their jobs. So, after development of the survey instrument is completed, the questionnaire is administered to large samples of career field incumbents throughout the Air Force. In fact, for career fields that contain fewer than 3,000 incumbents, a 100 percent sample is solicited. For larger career fields, a random stratified sample is surveyed, ensuring

good representation across relevant subgroups. Return rates run approximately 80 percent, providing a sample which is not only statistically adequate, but politically acceptable as well.

In completing the questionnaire, job incumbents first fill in the Background Information Section of the instrument, and then "take an inventory" of their present job by simply reading through the task list and checking off each task they perform in their present job. Then they go through the list of tasks a second time and rate on a 9-point scale the relative amount of time they spend on each task they perform. The results of this activity provide the survey analyst with the basic data needed in the occupational analysis of a career field: the percentage of incumbents who perform a task and the amount of time spent performing each task.

Data Analysis. Analysis of survey data is the third stage in the occupational analysis process. Here the survey analyst is interested in a number of analyses, but for purposes of this paper, I will limit discussion to only those analyses related to training. With the aid of computer programs developed by the Air Force Human Resources Laboratory, job descriptions can be formed for any of a number of subgroups within a career field. Specifically, one can examine the percentage of airmen in their first enlistment who perform various tasks as well as the percentage of their time spent on a task or group of tasks. Through a combination of data from the Background Information Section of the questionnaire and data from the task inventory, one can compute the average experience level for each task, which leads to a determination of when in a person's career he or she is most likely to begin performing a task. Job descriptions can also be computed for groups based on the geographical or organizational location of various respondents' jobs so differences can be determined in the tasks performed from place to place within the organization.

It should be clear from these brief descriptions that occupational analysis data allow the analyst to address questions concerning what should be trained, when it should be trained, and where it should be trained. For example, Air Force occupational survey data for first-enlistment personnel are routinely matched against training documents to determine if what is currently being trained is what is required by large percentages of course graduates after completion of the training program. Generally, tasks which are performed by at least 50 percent of the airmen in their first enlistment are considered strong candidates for basic formal technical training. Tasks performed by between 30 and 50 percent of first-enlistment personnel may be introduced in a basic course, but proficiency training is left for later on-the-job training (if and when the airman is required to perform those tasks). Finally, tasks performed by fewer than 30 percent of the first-enlistment personnel generally are not included in a basic course, since training on those tasks would not be cost-effective.

Often when survey data are matched to existing training programs, areas are found where training is being given on tasks that very few airmen are subsequently called upon to perform. Those areas are usually deleted from the course, unless specific justification can be given for retaining them, such as in the case of a safety requirement. In other instances, data will indicate that large percentages of airmen in their first enlistment are performing

tasks for which no formal training is currently being given. Training on those tasks usually is added to the course. Sometimes the application of occupational survey data to training programs results in money being saved, and sometimes it results in money being spent. But application of occupational survey data to training programs always results in training which more appropriately prepares people to perform those tasks for which there is a high probability they will be called upon to perform, thus maximizing the return on the organization's investment of training dollars.

Interaction With Data Users. The final step in the occupational analysis process involves the interactions between the occupational analyst, the survey data, and the potential data users, especially training development personnel. These interactions are accomplished through several avenues. First, an occupational survey report is written, detailing the findings of the survey with respect to a number of issues including those related to training. Findings are routinely delivered to training personnel at the technical school in the form of a briefing by the survey analyst, who then serves as a consultant to training personnel, helping them to interpret survey data. The analyst continues his consulting role through attendance at various career field meetings where training and utilization of personnel may be discussed, with occupational survey data serving as a reference which describes what "is" in the career field. In all of these interactions, survey data are presented not as the answer to every problem facing the career field, but rather as a tool to aid decision-makers in choosing courses of action that will enhance the organization's chances of accomplishing its goals.

COST-EFFECTIVE TRAINING: AN AIR FORCE REALITY

The occupational analysis procedures just described provide a firm theoretical basis for developing and maintaining cost-effective training programs, whether those programs be in the US Air Force or in some other large organization. The real test, however, is in the application of theories to real world situations. How effective has occupational analysis been in ensuring that training dollars are spent in a cost-effective way?

The Air Force has been in the business of applying occupational analysis data to training programs in some form for over 15 years, and in that time there have been many examples of training programs where revision has resulted in money saved and more effective course graduates. For example, in the early 1970s, a 13-week training program for general medical service personnel was shortened to 9 weeks following the application of survey data, resulting in an annually recurring savings of over $1 million and 1,000 man-days of training time. Just recently, an occupational survey of the Munitions Systems career field revealed substantial amounts of training being given to first-enlistment personnel in the area of missile maintenance, even though virtually none of them were performing tasks associated with that training. Using occupational data, plans to reduce the 62-day course to one of only 35 days were set in motion at a December 1984 Utilization and Training Workshop (the Air Force equivalent of a joint industry-vocational education advisory group).

But when we are speaking of success in the pursuit of cost-effective training, we are not merely interested in cases where training programs can be cut to save money. Cost-effectiveness implies getting the most for our training dollars, even if it means taking the money saved through the application of survey data in one career field and spending it in another. That is precisely what occurred in the case of the Aircraft Fuel Systems career field, where survey data revealed large percentages of first-enlistment personnel were performing tasks associated with the maintenance and repair of external fuel tanks, but where no training was being given to prepare them to do so. Adjustment to that course resulted in better trained airmen, more appropriately prepared to perform the tasks they would in all likelihood be called upon to perform.

One of the standard questions in the Background Information Section of the job inventory asks respondents to indicate the degree to which their jobs utilize their training. Over the years, there has been a marked increase in the percentage of airmen who respond positively to that question, providing another favorable assessment of the effectiveness of using occupational survey data to fine-tune training programs. And when that percentage is not so high, there is usually a correspondingly large mismatch between material covered in the training program and tasks performed in the field. Training personnel move quickly to fix those problems.

And so, we have seen how occupational survey data can be used to develop and maintain cost-effective occupational education and training programs for the good of an organization. The US Air Force, like many corporations, is a very large organization with serious training concerns. The wise and prudent expenditure of training dollars is one basis for the success of any organization, and the Air Force is no different from other organizations in that regard. Cost-effective training through occupational analysis helps to ensure our personnel are capable of performing their jobs when they're called upon to do so. In the corporations of America, well-trained people make for satisfied customers and healthy profits. But, in the Air Force, profits are not measured in dollars and cents or in percentage of return to our stockholders. In the Air Force, profits are measured in terms of combat readiness and effectiveness. Our stockholders are the people of the free world. Air Force training programs have to be good. Our investors' survival depends on it!